

Appendix C:

Sediment Contamination

Target Ecosystem Characteristic (TEC)

Section 3.4 of the Comprehensive Restoration Plan (CRP) Volume I introduced the Sediment Contamination Target Ecosystem Characteristic (TEC). The objectives of this TEC focus on removing existing contamination and restoring conditions to prevent the future accumulation of contaminants in the Hudson Raritan Estuary (HRE) study area.

Currently, every planning region of the HRE study area has exhibited some degree of sediment degradation due to contamination, though much of this results from the persistence of legacy chemicals in the benthic environment and within aquatic organisms. In recognition of this issue's importance, Federal, state (NY and NJ), and city natural resource agencies and estuary management programs (i.e., The NY/NJ Harbor Estuary Program) have undertaken programs to reduce the degree of contamination within sediments of the HRE. The Regional Environmental Monitoring and Assessment Program (REMAP) conducted by the USEPA in 1993-1994 and again in 1998, found that pervasive contamination across chemical groups in the HRE study area had declined (Adams and Benyi 2003). Improvements in sediment quality will have important implications to the biological and recreational value of the estuarine ecosystem, to the success of other TECs, to human health and safety, and to the port's economic viability (Bain et al. 2007).

Target Statement

Although the rate of contaminants entering the estuary have substantially declined since the pre-Clean Water Act era, many contaminants still enter from tributaries or are widely distributed throughout the HRE study area as historically contaminated sediments are transported by tides and currents (USACE 2004). The short-term objective for this TEC is to isolate or remove one or more sediment zone(s) totaling at least 25 acres which is contaminated based on 10-day toxicity testing, 28-day bioaccumulation testing and direct measurements of concentrations weighed against state-imposed risk-based limits by 2015. The long-term objective is to, starting in 2014, isolate or remove one or more such areas totaling at least 25 acres every 2 years until 2050 or until such time as all HRE sediments are considered uncontaminated based on the all related water quality standards, related fishing / shelling bans or fish consumption advisories, and any newly-promulgated sediment quality standards, criteria or protocols.

Restoration Opportunities

Two analytes of concern were evaluated in 3.4.1 Sediment Contamination of CRP Volume 1 (2,3,7,8 tetrachlorodibenzo-p-dioxin [TCDD] and Total PCB), and an additional five analytes were selected as the contaminants of concern for this analysis: Total DDT, Benzo(a)pyrene, 2,3,4,7,8 Pentachlorodibenzofuran (PeCDF), Total Dioxin/Furan, and Total Chlordane. The relative concentration of these contaminants throughout the HRE study area is presented as percentiles on Maps C-1 through C-5. For the contaminants that have established Effects Range Low (ERL) and/or Effects Range Medium (ERM) values, these benchmarks are displayed on the maps. For those contaminants with no established benchmark (e.g. Total Dioxins/Furans, Total Chlordane) the level of risk is generally determined through risk assessment of higher trophic levels. These evaluations will be conducted on a more localized basis through specific follow-up risk assessment activities.

These maps are not at a scale where contaminant “hot spots” can be identified. However, they can be used to understand the extent of contamination in the sediments, and to identify the large areas with the highest concentrations within the HRE study area. Detailed evaluations of site-specific cores within individual study areas would need to be conducted to identify individual hot spots.

Total DDT

The Total DDT concentrations predicted for the top 10 centimeters of the sediments in the HRE study area are displayed on Map C-1. The CARP model predicted that Total DDT concentrations in the HRE sediments range from 5 to 803 parts per billion (ppb or ng/g). About 39.5% of the predicted Total DDT concentrations of surface sediments exceed the ERM (46 ppb), and 100% of the surface sediments exceed the ERL (2 ppb). The areas with the highest concentrations (>125 ppb) include western Raritan Bay (Inset B), the Arthur Kill, eastern Jamaica Bay (Inset C), the mouth of the Bronx River and the lower portion of Newark Bay. The model predicted that all of the surface sediments of the Newark Bay, Hackensack River and Passaic River exceed the ERM for Total DDT (Inset A). The lowest concentrations (< 20 ppb) were predicted for the Lower Hudson River, western Long Island Sound and the Upper Bay.

Benzo(a)pyrene

Map C-2 displays predicted concentrations of the PAH Benzo(a)pyrene for the top 10 centimeters of sediment throughout the HRE study area, where concentrations were predicted to range between 65.6 and 2061.1 ppb. Approximately 62.6% of the surface sediments of the HRE study area are predicted to exceed the ERL of 430 ppb, and about 3.3% are expected to exceed the ERM of 1600 ppb. The areas with the highest predicted concentrations of Benzo(a)pyrene (> 1259 ppb) include the Hackensack River (Inset A), the upper East River (Inset B), and western Jamaica Bay (Inset C). The areas with the lowest

predicted concentrations (<235 ppb) of Benzo(a)pyrene are the lower Hudson River, lower Raritan River, and western Long Island Sound.

2,3,4,7,8 – PeCDF

The 2,3,4,7,8 – Pentachlorodibenzofuran (PeCDF) concentrations predicted for the top 10 centimeters of sediment within the HRE study area are displayed on Map C-3. Concentrations of this furan are estimated to range between 0.0022 and 0.0458 ppb throughout the HRE study area. There are no ERM or ERL values associated with this type of furan. The highest concentrations (> 0.014 ppb) were predicted for the Hackensack and Passaic Rivers (Inset A), western Jamaica Bay (Inset B) and the southern shoreline of Lower Bay (Inset C). The lowest concentrations (< 0.002 ppb) were predicted for the lower Hudson River.

Total Dioxin / Furan

Map C-4 displays the Total Dioxin / Furan concentrations predicted for the surface sediments throughout the HRE study area, where concentrations were predicted to range from 0.0019 to 0.2107 ppb. There are no ERM or ERL values associated with this contaminant. The highest concentrations (> 0.05) in the surface sediments were predicted for the Passaic and Hackensack rivers (Inset A), Newark Bay, western Jamaica Bay (Inset B), and the southern shore of Raritan Bay (Inset C). Again, higher concentrations occur several feet below the surface sediments in the lower Passaic River. The lowest predicted concentrations (< 0.01 ppb) occur in the lower Hudson River.

Total Chlordane

The predicted concentrations of Total Chlordane in the HRE study area range between 2.2 and 118.3 ppb throughout the HRE study area (Map C-5). There are no ERM or ERL values for this chemical pesticide. The highest concentrations (> 30 ppb) were predicted for the Hackensack River (Inset A), the bays off the upper East River (e.g. Flushing Bay; Inset B), and western Jamaica Bay (Inset C). Lowest concentrations (< 5.1 ppb) were predicted for the Hudson River (north of Manhattan) and western Long Island Sound.

Summary

Surface sediment contamination is pervasive throughout the HRE study area, but the highest concentrations of several contaminants of concern occur in relatively few places. The Passaic River, Hackensack River, Newark Bay, western Jamaica Bay and Raritan Bay have nearly the highest predicted concentrations for each contaminant evaluated. This is a concern due to the potential effects of interaction among these contaminants, bioaccumulation, and toxicity. These regions represent opportunities to significantly increase the habitat value by decreasing the effects of contamination. Further evaluation of sediment contamination should be evaluated for human health and ecological risk to inform remedial

decision-making. This is currently underway within the lower Passaic River, Newark Bay, Gowanus Canal and Hackensack River.

References

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- Bain, M., J. Lodge, D.J. Suszkowski, D. Botkin, A. Brash, C. Craft, R. Diaz, K. Farley, Y. Gelb, J.S. Levinton, W. Matuszeski, F. Steimle and P. Wilber. 2007. Target Ecosystem Characteristics for the Hudson Raritan Estuary: Technical Guidance for Developing a Comprehensive Ecosystem Restoration Plan. A report to the Port Authority of NY/NJ. Hudson River Foundation, New York, NY. 106 pp.
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